WP2-A6. RockChain Curriculum: Production of a rock ornamental waste management curriculum using blockchain technology.

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Centro Tecnológico del mármol, piedra y materiales

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CONTENTS

1. INTRODUCTION

The RockChain project responds to the increasing demand for transversal digital competences within traditional industrial sectors, with a focus on the ornamental stone industry. As highlighted in Article 173 of the Treaty on the Functioning of the European Union, the Union's industrial policy should support the full exploitation of innovation, research, and technological development. Aligned with this principle, RockChain aims to strengthen the sector's transition towards a Circular Economy, supported by digital transformation and smart technologies.

The ornamental rock sector, deeply rooted in traditional extraction and manufacturing processes, is confronted with new regulatory and societal expectations related to waste reduction, resource efficiency, and climate neutrality. In parallel, the sector experiences a growing digital skills gap. According to European Commission data, 37% of the EU workforce lacks essential digital skills, creating a barrier for the deployment of emerging technologies such as Blockchain, Internet of Things (IoT) and Big Data.
In this context, the RockChain project contributes to the modernisation of vocational education and training (VET) for professionals over the age of 45 and for technical staff in the stone, construction and waste management sectors. The project focuses on the integration of blockchain technologies as an enabler of trust, traceability, and transparency in waste data management. These tools are essential in ensuring data integrity in increasingly complex value chains—particularly when dealing with secondary raw materials and waste flows.

Over recent years, blockchain has emerged as a powerful solution for environmental sustainability, offering new paradigms for strategic planning, logistics, and resource traceability. Its application in Smart Cities and Circular Economy models has demonstrated its capacity to secure data flows, ensure tamper-proof certification, and promote distributed accountability.

Through the RockChain curriculum, the project aims to equip target learners with the knowledge and practical competences to:

- Understand the structure and environmental challenges of the ornamental rock value chain.
- Apply blockchain for traceable and decentralised waste management systems.
- Support the reintroduction of waste into the value chain through data-driven circular strategies.
- Promote zero-impact approaches and the recognition of stone waste as a valuable resource.

The educational innovation proposed in RockChain is underpinned by a modular curriculum and a digital learning platform designed to simulate real-world blockchain use cases in the sector. The platform will allow learners to visualise and experiment with data registration, smart contracts, and waste traceability workflows, creating a bridge between theory and application.

By fostering digital upskilling and sustainability awareness, RockChain contributes directly to the twin green and digital transitions defined in the EU Industrial Strategy and the European Skills Agenda. It empowers a demographic segment often overlooked in digital transformation processes—older professionals—ensuring their active role in building a climate-resilient and technologically modernised stone industry.

2. COURSE DATA

Denomination: ROCKS WASTE MANAGEMENT APPLYING BLOCKCHAIN TECHNOLOGY

Module: *

Duration: 50 hours

Course Code: *

Teaching period: *

Degree in which it is taught: *

Other qualifications that could be offered:
Mining / Quarrying
Architecture / Civil Engineering
Environmental Engineering
Management / Marketing
Master's programmes related

Centre: *

Language: Official Language**

Theory class schedule: *

Practice class schedule: *

Place: *

(*) All fields marked with an asterisk are subject to completion with school-specific information.

(**) Currently available in English, German, Spanish, Romanian and Croatian.

3. TEACHER PROFILE

Teacher in charge: *

Department: *

Area of Knowledge: *

Teacher's Office Location: *

Phone: *

Email: *

URL / WEB: https://rockchain.eu/

Tutorial schedules: *

Tutorial Location: *

Teaching and research profile: *

(*) All fields marked with an asterisk are subject to completion with school-specific information.

4. COURSE OVERVIEW

4.1 Overview

This course explores the integration of blockchain technology in managing waste from rock processing industries, emphasizing the use of stones as an ecological material, as well as promoting stones as sustainable materials for reuse and recycling. The course also covers the lifecycle of rock waste, including mining operations, stone quarries, stone processing, storage, transport, and marketing of stone blocks from a blockchain perspective.

4.2 Overview of the Thematic Areas

The course provides a comprehensive examination of the processes and challenges involved in managing waste generated by the rock and stone industries. The subject is structured around three core themes: the lifecycle of rock waste, the application of blockchain technology, and the promotion of sustainable stone use in architecture and civil engineering.

In this way, students will:

- gain a deep understanding of the environmental and economic implications of rock waste, including the challenges of managing waste at different stages, from extraction and processing to storage, transport, and eventual disposal or recycling;
- learn how blockchain can enhance the traceability, transparency and efficiency of waste management processes;
- understand how blockchain can be used to track the origin, movement, and disposal of waste materials, thereby promoting the circular economy, accountability and reducing environmental impact;
- understand the potential of blockchain to revolutionize logistics, storage, and the marketing of stone blocks by providing secure and verifiable records;
- learn about the role of stones as a sustainable material;
- develop strategies for promoting stone as an eco-friendly material in the construction industry and other sectors, addressing the need for sustainable sourcing, processing, and marketing practices;
- think critically about the social and environmental responsibilities of the stone industry.

By the end of the course, students will be equipped with the knowledge and skills to manage rock waste effectively, leverage blockchain technology for sustainability, and advocate for the use of stones as a key component of green architecture and civil engineering.

4.3 Prior knowledge required

No prior technical knowledge of blockchain or digital technologies is required to enrol in the RockChain course. However, participants are expected to have basic digital literacy (e.g. navigating files, using a browser, completing online forms) and professional experience or familiarity with the ornamental stone, construction, or waste management sectors. This background will support contextual understanding and enable participants to connect the course content with real-world practices in their respective industries.

4.4 Material resources

Minimum list of material resources (equipment, tools and instruments, models, raw materials and materials, technical, economic, legal documentation, etc.), necessary to obtain the learning outcomes:

- multimedia facilities;
- training tutorials on using applications;
- devices with internet access, video projector;
- software: RockChain e-Learning tool and RockChain platform.

4.5 Recommendations

(*) Completion subject to the criteria of the educational centre.

Example:

- prerequisite knowledge: basic understanding of environmental science, mining operations, architecture, civil engineering, and introductory blockchain concepts;
- recommended skills: analytical thinking, problem-solving and proficiency in digital tools.

4.6 Special measures envisaged

(*) Specific regulations of the educational centre with respect to the establishment of special adaptation in the methodology and the development of teaching for students who suffer from some type of disability or limitation.

(*) All fields marked with an asterisk are subject to completion with school-specific information.

4.7 Teaching

The RockChain course will be delivered using a learner-centred and competence-based approach, tailored to the needs of adult professionals, particularly those over 45 years old working in the ornamental stone and construction sectors. The teaching methodology will combine theoretical instruction with practical application, ensuring that learners understand not only the concepts of blockchain and circular economy but also how to apply them in their specific industrial context.

Training sessions will be structured around interactive learning methods, including group discussions, collaborative exercises, guided simulations, and real-life case studies. Particular emphasis will be placed on the use of the RockChain learning tool, a digital platform developed as part of the project to simulate blockchain-based traceability and smart contract workflows. The final unit will involve an integrative project, where learners will apply their knowledge and skills to a practical challenge, reinforcing learning through experiential application.

Throughout the course, tutoring and peer learning will be promoted to support participants with lower levels of digital confidence, ensuring inclusivity and fostering intergenerational knowledge exchange. Trainers will act as facilitators, encouraging active participation, critical thinking, and autonomy. All course materials will be designed for clarity and accessibility, with a strong focus on real-world relevance and sectoral transferability.

5. OVERALL LEARNING OUTCOMES

5.1 Expected Knowledge Outcomes

Upon successful completion of the RockChain course, learners will have acquired a solid and multidisciplinary body of knowledge covering the ornamental rock industry, the circular economy, the fundamentals and applications of blockchain technology, and the broader context of digital transformation and sustainable innovation.

The expected knowledge outcomes are grouped under four complementary domains:

A. Knowledge of the Ornamental Rock Sector and Its Environmental Challenges

This domain establishes the sectoral context needed to link subsequent knowledge areas with real industrial challenges and value creation opportunities. Learners will understand:

- The structure and functioning of the ornamental rock value chain, from extraction and transformation to distribution and end use, including the key actors and interdependencies across the supply chain.
- The types of ornamental stone materials (e.g. marble, granite, slate, limestone), their properties and their typical applications in construction, urban design, and architecture.
- The technical and economic characteristics of waste generated in the stone industry, including fine particles, saw sludge, broken pieces and quarry residues.
- The environmental implications of waste mismanagement, such as land occupation, air and water pollution, and inefficient use of natural resources.
- The key challenges facing the sector, including low digitalisation, rising regulatory demands, lack of skilled workforce, and public pressure for sustainable practices.

B. Knowledge of Circular Economy Principles and Waste Valorisation

This knowledge domain enables learners to embed sustainability into technical decision-making, policy alignment and innovation planning. Learners will understand:

- The core concepts of the circular economy (CE), including closed-loop systems, waste-as-resource, extended product lifecycles, and systemic thinking.
- The differences between linear and circular models, and the advantages of CE approaches in terms of economic resilience, material efficiency and regulatory alignment.

- Strategies for circularity in the stone sector, including by-product valorisation, secondary raw materials, industrial symbiosis and design for reuse.
- The European and national regulatory frameworks related to circular economy and waste (e.g. Waste Framework Directive, Construction and Demolition Waste Protocol, EU Green Deal).
- The notion of zero impact and regenerative design, particularly in relation to quarry rehabilitation, eco-design of products, and emissions reduction.

C. Knowledge of Blockchain and Digital Traceability Systems

This domain ensures that learners develop a functional and applied understanding of blockchain, without requiring prior technical or IT knowledge. Learners will understand:

- The basic architecture of blockchain systems, including blocks, hash functions, distributed ledgers, consensus protocols, nodes, and transaction validation.
- The main benefits of blockchain in industrial contexts: immutability, decentralisation, trustless verification, transparency and fraud prevention.
- The concept and functioning of smart contracts, including their potential for automating compliance, workflow coordination, and environmental reporting.
- Differences between blockchain and traditional databases, including data integrity, accessibility and security mechanisms.
- The role of blockchain in traceability systems, allowing secure registration of origin, movement, treatment and reuse of materials and waste across multi-actor chains.
- How blockchain can be combined with other technologies such as IoT, smart sensors, digital twins and cloud systems to reinforce the reliability and auditability of data.

D. Knowledge of Digitalisation, Green Transition and Lifelong Learning

This final knowledge pillar supports a more holistic and human-centred vision of technology adoption, preparing learners to act both as professionals and citizens in a rapidly evolving context. Learners will understand:

- The transformative role of digital technologies in modernising traditional sectors and improving environmental outcomes through better data, monitoring and automation.
- The relationship between digitalisation and the Green Deal, particularly in the context of the twin transition and the European Skills Agenda.
- The importance of data ethics, cybersecurity and responsible digital practices, especially when managing environmental or operational data across stakeholders.

- The need for lifelong learning and continuous upskilling, especially for professionals over 45 in low-digital sectors, to adapt to new tools and expectations.
- The social, organisational and cultural dimensions of digital transformation, including resistance to change, digital literacy gaps, and intergenerational learning.
- The potential for empowerment and inclusion through accessible training programmes such as RockChain, which allow adult learners to regain confidence and relevance in the labour market.

5.2 Expected outcomes of the competitions

The RockChain curriculum is designed to foster a blend of technical, digital, and transversal competences that equip learners to engage actively and responsibly in the digital transformation of the ornamental stone sector, with a particular focus on waste management and circular economy strategies enabled by blockchain technology.

Learners completing the course will develop competences across three key domains:

A. Sectoral and Technical Competences.

These competences enable learners to act as informed technicians, quality supervisors or sustainability officers within extraction, transformation or waste management companies in the natural stone industry. Learners will be able to:

- Map and analyse the ornamental rock value chain, identifying the stages where waste is generated and where circular strategies could be introduced or strengthened.
- Characterise different types of stone waste, assessing their physical and chemical properties and their potential for reuse, recycling or recovery.
- Evaluate current waste management practices in the stone sector and contrast them with circular economy principles and regulations.
- Propose circular alternatives for stone waste, considering technical feasibility, environmental impact, market demand and cost-effectiveness.
- Design or interpret basic flow diagrams of stone waste management systems, identifying critical control points for traceability and compliance.

B. Digital and Blockchain Competences.

These competences prepare learners to take part in digitalisation processes within industrial contexts, particularly in roles where data integrity, compliance automation, or traceability systems are relevant. Learners will be able to:

- Describe the fundamental logic of blockchain systems, including how information is stored, secured and shared across decentralised networks.
- Operate within a simplified blockchain learning environment, including the ability to input data, monitor transactions and simulate smart contract behaviour.
- Apply blockchain logic to traceability workflows, identifying how material data can be recorded, verified and linked to actors within the value chain.
- Design basic smart contract scenarios for waste handling, such as automatically recording delivery confirmations, flagging non-compliance or triggering alerts when thresholds are exceeded.
- Link blockchain data to real-world inputs from sensors or monitoring systems, ensuring data accuracy and reducing risks of manipulation.

C. Sustainability and Circular Economy Competences.

These competences are vital for fostering a proactive, green-aware workforce, capable of contributing to the EU's Green Deal and Circular Economy Action Plan goals. Learners will be able to:

- Explain the principles of the circular economy and how they apply to the stone industry and other material-intensive sectors.
- Interpret environmental regulations and sustainability criteria, including EU waste hierarchy, EPR (Extended Producer Responsibility), and the EU Taxonomy Regulation.
- Integrate circularity and sustainability principles into technical decision-making, balancing operational, environmental and economic factors.
- Critically assess the environmental impact of linear processes, and propose alternative models aligned with climate-neutral and zero-waste objectives.
- Communicate sustainability-related improvements clearly and effectively to colleagues, clients or institutional stakeholders.

D. Transversal and Soft Competences.

These transversal competences are aligned with the European Key Competences for Lifelong Learning, particularly digital competence, personal and social competence, and citizenship competence in sustainability. Learners will also develop key transversal skills that support their employability and ability to adapt in changing industrial and technological environments:

- Problem-solving and critical thinking, particularly when integrating new technologies into traditional sectors.

- Teamwork and collaboration, including the ability to work across disciplines (e.g., IT and environmental management) and communicate with stakeholders of varying technical backgrounds.
- Adaptability to technological change, cultivating a learning mindset in the face of Industry 4.0 developments.
- Digital literacy, beyond blockchain, including safe and responsible use of digital tools, basic data management, and interpretation of digital workflows.
- Technical communication, with the ability to document, present and explain technical processes clearly using appropriate terminology.

5.3 Attitudes, expected results

Beyond knowledge acquisition and competence development, the RockChain course aims to foster a shift in attitudes, values, and professional identity among adult learners in the ornamental stone sector. In line with the objectives of the European Skills Agenda and the Council Recommendation on Key Competences for Lifelong Learning, the course promotes attitudes that enable learners to become active agents of change in their work environments and communities.

Upon successful completion of the course, learners are expected to demonstrate the following attitudinal outcomes:

A. Attitudes Towards Sustainability and Circular Economy.

These attitudes support a culture of responsibility and stewardship, where learners see themselves not just as operators or technicians, but as custodians of natural resources and enablers of positive change.

- A genuine commitment to sustainability as a guiding principle in their professional practice, particularly in relation to resource efficiency, waste reduction and environmental protection.
- An appreciation of circular economy thinking, not merely as a compliance obligation but as a strategic opportunity for value creation and innovation within the stone sector.
- A willingness to question established practices and embrace process redesigns that favour environmental regeneration and reduced extraction.
- A growing awareness of the long-term impacts of industrial activity on ecosystems, climate, and communities.

B. Attitudes Towards Digital Innovation and Technology Adoption.

These attitudes are critical to overcoming the digitalisation gap faced by professionals over 45 and to facilitating smoother transitions in industrial modernisation processes.

- An open and curious mindset toward new technologies, including blockchain, even when unfamiliar or outside of prior experience.
- Increased confidence in experimenting with digital tools, platforms, and interfaces, and reduced resistance to technological change.
- A constructive attitude towards learning, including self-directed learning and upskilling as ongoing professional responsibilities.
- A proactive stance towards integrating digital solutions in traditional work environments, understanding their potential to improve transparency, traceability and collaboration.

C. Attitudes Towards Collaboration, Ethics and Professional Growth.

These attitudes contribute to building a resilient and adaptable workforce, able to navigate uncertainty, embrace change, and participate actively in shaping the future of their sector.

- A collaborative spirit, valuing cross-sector and intergenerational exchange of knowledge, particularly in multidisciplinary teams dealing with sustainability and digital transformation.
- A strong sense of professional ethics, including respect for data integrity, transparency, and fair stakeholder engagement in traceability systems.
- A sense of initiative and autonomy, recognising their role not only as learners but as potential change agents within their organisations.
- Greater self-esteem and motivation, stemming from the ability to engage with emerging technologies and participate in projects of relevance and impact.

D. Overall Expected Attitudinal Impact

This attitudinal shift enables learners to reframe their professional identity and participate meaningfully in the sector's ongoing transition towards sustainability, circularity and digital trust. The overall expected result is the internalisation of a dual awareness:

- First, that the stone sector is evolving, and that environmental and digital pressures are not threats, but levers for transformation.
- Second, that their own role as mature professionals is still essential—not despite the emergence of new technologies, but precisely because of their sectoral experience, operational knowledge, and newfound digital awareness.

6. COURSE STRUCTURE

UNIT 1. Introduction to the Ornamental Stone and Mining Industry.
1.1. Overview of the sector: scale, impact, main countries.
1.2. Types of ornamental stones (marble, granite, slate, limestone...).
1.3. From quarry to market: the industrial process.
1.4. Key stakeholders: SMEs, associations, institutions.
1.5. Current challenges: energy costs, CO_2 emissions, traceability.
1.6. Legal and environmental context (European Green Deal, taxonomy...).
UNIT 2. Blockchain Fundamentals.
2.1. What is blockchain? Origin and evolution.
2.2. Basic concepts: blocks, chain, hash, timestamp, cryptography.
2.3. Distributed ledgers and decentralization.
2.4. Smart contracts: definition and uses.
2.5. Comparison with traditional databases.
2.6. Use cases in logistics, finance, waste management, and mining.
UNIT 3. Circular economy in the context of ornamental stone.
3.1. Definition and pillars of circular economy (reduce, reuse, recycle).
3.2. From linear to circular models: challenges and benefits.
3.3. Circular practices in extraction, transformation and product design.
3.4. Valorisation of stone waste: aggregates, fillers, decoration, etc.
3.5. CE and digitalization: traceability, data, lifecycle monitoring.
3.6. EU context: Green Deal, Circular Economy Action Plan, taxonomy.
UNIT 4. Blockchain applied to waste management.
4.1. Waste streams in ornamental stone processing: types and destinations.
4.2. Legal obligations and reporting requirements in waste management.
4.3. Blockchain applications: material passports, digital twins, decentralized ledgers.
4.4. Smart contracts for compliance, reporting and incentives.
4.5. Integration of blockchain with IoT and data collection tools.
UNIT 5. RockChain. Final practical exercise: integrative project.
5.1. RockChain platform functionalities (navigation, modules, user roles).
5.2. Templates and workflows for traceability registration and smart contract simulation.
5.3. Case study structure: actors, assets, flows, checkpoints, compliance steps.
5.4. Reporting and documentation best practices.

UNIT 1. Introduction to the Ornamental Stone and Mining Industry.

This unit provides learners with a foundational understanding of the ornamental rock industry, from extraction to market, including its key materials, stakeholders, industrial structure, and sustainability challenges. It sets the context for the entire RockChain curriculum, enabling learners to grasp the complexity and transformation needs of this traditionally non-digital sector.

1.1. Overview of the sector: scale, impact, main countries.

Presents the economic and geographic relevance of the ornamental stone sector in the EU and globally.

1.2. Types of ornamental stones (marble, granite, slate, limestone...).

Explains the main categories of natural stone and their typical industrial uses and properties.

1.3. From quarry to market: the industrial process.

Describes the main industrial phases from raw block extraction to product distribution.

1.4. Key stakeholders: SMEs, associations, institutions.

Introduces the network of actors shaping the industry, including public and private bodies.

1.5. Current challenges: energy costs, CO_2 emissions, traceability.

Analyses the most pressing environmental and operational issues affecting the sector today.

1.6. Legal and environmental context (European Green Deal, taxonomy...).

Outlines relevant policy frameworks driving change in the extractive and stone transformation sectors.

UNIT 2. Blockchain Fundamentals.

This unit introduces the basic principles and components of blockchain technology in a clear and accessible way. It enables learners with no prior technical background to understand how blockchain functions, how it differs from traditional systems, and how it can support transparency and decentralisation in various sectors.

2.1. What is blockchain? Origin and evolution.

Presents blockchain’s emergence, from its origins in cryptocurrency to broader industrial adoption.

2.2. Basic concepts: blocks, chain, hash, timestamp, cryptography.

Breaks down how data is structured and protected in a blockchain system.

2.3. Distributed ledgers and decentralization.

Explains how decentralised architecture increases trust and resilience in data systems.

2.4. Smart contracts: definition and uses.

Introduces learners to programmable logic within blockchain networks.

2.5. Comparison with traditional databases.

Highlights the operational and strategic differences between blockchain and legacy systems.

2.6. Use cases in logistics, finance, waste management, and mining.

Presents sector-specific examples, building relevance for learners in the natural resource industry.

UNIT 3. Circular Economy in the Context of Ornamental Stone.

This unit explores the principles of circular economy and their application to the ornamental stone value chain. It explains how waste can be reduced, reused or transformed into new resources, and how EU frameworks are pushing this transition through policy, regulation and innovation incentives.

3.1. Definition and pillars of circular economy (reduce, reuse, recycle).

Explains core CE concepts and how they contrast with linear industrial models.

3.2. From linear to circular models: challenges and benefits.

Analyses the systemic shift needed for circularity and barriers to adoption.

3.3. Circular practices in extraction, transformation and product design.

Highlights examples of how circularity can be embedded across the value chain.

3.4. Valorisation of stone waste: aggregates, fillers, decoration, etc.

Explores reuse pathways and potential markets for stone waste and by-products.

3.5. CE and digitalization: traceability, data, lifecycle monitoring.

Introduces the role of data and digital tools in enabling CE implementation.

3.6. EU context: Green Deal, Circular Economy Action Plan, taxonomy.

Connects CE concepts with EU legislative drivers and funding frameworks.

UNIT 4. Blockchain Applied to Waste Management.

Building on prior units, this unit applies blockchain technology to the specific context of waste management in the stone industry. Learners explore how digital traceability systems can improve compliance, monitoring, and resource efficiency.

4.1. Waste streams in ornamental stone processing: types and destinations.

Categorises stone industry waste flows and outlines typical management pathways.

4.2. Legal obligations and reporting requirements in waste management.

Summarises regulatory responsibilities concerning waste control and documentation.

4.3. Blockchain applications: material passports, digital twins, decentralised ledgers.

Explores blockchain-based tools for lifecycle transparency and data permanence.

4.4. Smart contracts for compliance, reporting and incentives.

Shows how logic-based systems can automate and secure waste management operations.

4.5. Integration of blockchain with IoT and data collection tools.

Explains how blockchain platforms can interface with sensors and smart equipment.

UNIT 5. RockChain. Final Practical Exercise: Integrative Project.

This capstone unit enables learners to consolidate their acquired knowledge by applying it in a simulated or real case using the RockChain learning platform. Through collaborative or individual work, they will simulate waste traceability workflows using blockchain logic and generate outputs aligned with real-world needs.

5.1. RockChain platform functionalities (navigation, modules, user roles).

Provides an introduction to the digital environment where the practical exercise will take place.

5.2. Templates and workflows for traceability registration and smart contract simulation.

Supports learners in applying their knowledge through structured project tools.

5.3. Case study structure: actors, assets, flows, checkpoints, compliance steps.

Outlines how learners will simulate a value chain scenario in a circular economy context.

5.4. Reporting and documentation best practices.

Teaches how to produce clear, auditable records of traceability and compliance.

7. TEACHING METHODOLOGY

Activity	Teaching techniques	Student's work	Hours
Theoretical classes.	Expositive classes of the theoretical contents, using the method of lesson dialogue. Resolution of doubts raised by students.	On-site:	**5**
		Non-on-site:	
Solution of problems and practical cases.	Resolution of practical cases. Problems are proposed to students for their resolution. Proposition of exercises for resolution at home.	On-site:	
		Non-on-site:	2
Searching for and expanding documentation.	Search for information, management of databases and use of tools.	On-site:	
		Non-on-site:	5
Cooperative work activities.	Resolution of practical cases. Working groups will be set up using RockChain e-Learning tool, monitoring the participation of the group's members.	On-site:	
		Non-on-site:	5
Tutorials.	Resolution of doubts about theory, problems, practices and seminars.	On-site:	
		Non-on-site:	5
Seminars and visits to companies and facilities.	In the seminars, specific topics of the theoretical syllabus will be expanded. Depending on availability, a visit will be made, or the assistance of an environmental management professional will be scheduled.	On-site:	
		Non-on-site:	4
Work / Individual study.	Study of the subject using RockChain Platform.	On-site:	0
		Non-on-site:	20
Works / Informs / Formative evaluation activities.	Realisation of works and reports of practices to be delivered by the student. Follow-up and development of works, practices and reports.	On-site:	0
		Non-on-site:	2
Official exams	Preparation, correction and review of written tests.	On-site:	
		Non-on-site:	1
Exhibition of Works	Evaluation and correction of the expositions corresponding to the different works to be carried out by the student.	On-site:	
		Non-on-site:	1
			50

8. EVALUATION AND MONITORING METHODOLOGY

8.1 Proposed evaluation system

Activities	Systems and assessment criteria	Percentage Weight (%)
Written tests in the RockChain platform.	Theoretical-practical knowledge acquired by the student will be evaluated.	50
Assessment of practices cases with RockChain e-Learning tool.	Knowledge acquired in practices with ICT support will be evaluated.	20
Individual and teamwork assessment works	Development and presentations of individual and group works will be evaluated.	30
Other assessment activities	Attendance and participation to classes of the subject will be evaluated.	10

8.2 Course monitoring and feedback mechanisms

The control and monitoring of student learning will be done through the following actions:

- Active participation in discussions, practical sessions, and group work.
- Ongoing feedback on assignments, projects, and presentations.
- Regular submission of progress updates on individual or group projects.
- Scheduled tutorials to support learners and address difficulties.
- Completion of self-evaluation questionnaires to foster reflective learning.
- Assessment through written tests and evaluation of individual and group research tasks.

9. TEACHING RESOURCES AND RECOMMENDED BIBLIOGRAPHY

9.1 Bibliografy

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European Environment Agency (EEA). (2021). Circular Economy and Climate Change Mitigation: Policies and Practices in the EU. Luxembourg: Publications Office of the European Union.

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Zeyen, A., Beckmann, M., & Wolter, C. (2021). Blockchain and environmental sustainability: A review and research agenda. Business Strategy and the Environment, 30(8), 3883–3898.

9.2 Regulations

Circular Economy Action Plan (COM(2020) 98 final): A key component of the European Green Deal, promoting waste prevention, product lifecycle extension, and resource efficiency.

Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.

Directive (EU) 2010/75/EU on industrial emissions (IED): Establishes measures to prevent or reduce emissions into air, water and land from industrial activities, including quarrying and processing.

Digital Europe Programme (Regulation (EU) 2021/694): Promotes the adoption of advanced digital technologies, including blockchain and data infrastructure.

EU Construction and Demolition Waste Protocol and Guidelines: Non-binding guidelines issued by the European Commission to improve the traceability and management of C&D waste.

EU Data Act (Proposal COM/2022/68): Proposed regulation to ensure fair access to and use of data, including environmental and industrial data.

EU Data Governance Act (Regulation (EU) 2022/868): Establishes mechanisms for trustworthy data sharing across the EU.

EU Green Deal (2019): Strategic policy aiming to make Europe the first climate-neutral continent, with relevance for circularity, industrial transition and sustainability.

European Strategy for Data (COM(2020) 66 final): Lays the foundation for a European single market for data, supporting environmental and industrial data exchanges.

Level(s) (European Commission framework): A common EU approach to assess and report on the sustainability of buildings and construction materials.

Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment (EU Taxonomy Regulation).

9.3 Online resources and other resources

www.rockchain.eu

www.bkstoneproject.com

www.circularbim.eu

www.oerco2.eu